Remarks

Reconsideration of the application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-9 and 11 and 12 are pending in the application. These changes are believed to introduce no new matter, and their entry is respectfully requested. Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Summary of Objections, Claim Rejections and Discussion

The drawings were objected to under 37 C.F.R. 1.83(a) stating that the subject matter of claim 10 was not covered in any of the Figures. In response, Applicant has canceled claim 10.

Claims 1-10 were rejected under 35 U.S.C 112 second paragraph for failing to particularly point out and distinctly claim the subject matter to which Applicant regards as the invention. Please note modified claim one which replaces "an output coupled to the first cavity resonator" with "an output coupled to the second cavity resonator". This corrects any ambiguity.

The Examiner believes the language of claim 3, to wit: "a plurality of additional coaxial resonators" is vague and indefinite as to how the coaxial resonators are related to "first and second cavity resonators" recited in claim 1. Applicant believes that Examiner meant claim 4 and line 25 and comments accordingly. Claim three has been amended such that the germane section now reads, "a plurality of additional coaxial resonators,

electrically coupled in series to said first and second cavity resonators". Support for this is found in the specification at page 5, line 6. This clearly sets forth the relationship of the added elements of claim 4.

Claim 1 and 8 were rejected under 35 U.S.C. 102(b) as being anticipated by Das. Das discloses a cylindrical cavity that is loaded with a ferroelectric rod and is resonant at the dominant mode. The loaded cylidrical cavity is a band pass filter. As a bias voltage is applied across the ferroelectric rod, its permittivity changes resulting in a new resonant frequency for the loaded cylindrical cavity. The ferroelectric rod is operated at a temperature slightly above its Curie temperature. The loaded cylindrical cavity is kept at a constant designed temperature. The cylindrical cavity is made of conductors, a single crystal high Tc superconductor including YBCO and a single crystal dielectric, including sapphire and lanthanum aluminate, the interior conducting surfaces of which are deposited with a film of a single crystal high Tc superconductor.

Das does contemplates the use of a cylindrical cavity containing a ferroelectric rod whose permittivity is dependent on the electric field in which it is immersed and wherein, upon the application of a bias field, the permittivity of the ferroelectric rod changes resulting in changing the resonant frequency of the cylindrical cavity. However, Das utilizes Strontium Titanate and Lead Titanate compositions and $KTa_{1-X}\ Nb_XO_3$ (KTN). These compositions would not enable the performance set forth in the present invention. For example, at below or very near the curie temperature the loss would be minimal, but due to the ferroelectric nature of the material, at temperatures even moderately above curie, the loss is enormous and not suited for applications such as the

present invention. As modified claim one exhibits, the claims more clearly set for the material of the present invention operating in their paraelectric state.

Jackson also discloses a variable bandwidth filter that includes either a parallel or series combination of a fixed impedance, such as a capacitor, and a variable impedance, such as a variable capacitor. Thus, Jackson requires at least one of said first and second outer coupling impedances includes a fixed impedance element and a variable impedance element. Also, as with Das, Jackson does not disclosure the tunable dielectric material of the present invention in the structure herein described. Indeed, Jackson does not mention tunable material at all, much less the material of the present invention and in its paraelectric state.

The tunable dielectric material claimed and set forth in the present invention in combination with the structure set forth has been derived at through years of development to enable the performance characteristics set forth in the graphs of Figures 5, 8 and 9. These performance characteristics, which can operate well at 20 degree C or more above the curie temperature, would not be possible using the ferroelectric material and structure as set forth in Das or Jackson. Regarding Mueller, nor would be obvious to combine either with Mueller (discussed in more detail below) to anticipate the present invention. Mueller does disclose barium strontium titanate as used in a resonating cavity, however, that is fundamentally different with different functions and methods and structure than the present invention.

Regarding Mueller, the Examiner rejects claims 2, 3, 9 and 10 as being unpatentable over Das in view of Mueller et al. In rejecting the aforementioned claims under 35 U.S.C. 103(a), the examiner bears the initial burden of presenting a prima facie

case of obviousness. The assertion of obviousness must be reasonable in light of what the prior art substantively shows and teaches a person of ordinary skill in that art. In re Oetiker, 9 77 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). Only if that burden is met, does the burden of going forward with evidence or argument shift to the applicant.

For the reasons articulated below, the applicant believes that in the present case, the Examiner has not met this burden. A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 782, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993), quoting In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976).

Further, the mere fact that the prior art may be modified in the manner suggested by the examiner neither makes the modification prima facie obvious nor obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266, 23 USpQ2d 1780, 1783-84 (Fed. Cir. 1992). If the examiner fails to establish a prima facie case, the rejection is improper and will be overturned. In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

Mueller et al. discloses a detailed cavity tunable resonator, to wit: an electronically tunable resonating apparatus which uses a tunable dielectric material which is biased by an electric field to alter the resonant frequency in a resonating cavity. The electrodes which apply the electric field are connected to a variable voltage source. The electrodes can apply a plurality of electric field strengths and provide a range of resonant frequencies in the resonating apparatus.

As the Examiner is aware, in order to combine Das and Mueller et al. there should be a suggestion or teaching of combining the references to come up with the present invention. The applicant is unaware of any such suggestion or teaching combining the Ferroelectric Electronically Tunable Filter of Das and an electronically tunable resonating apparatus, which uses a tunable dielectric material which is biased by an electric field to alter the resonant frequency in a resonating cavity of Mueller. This is especially the case since Das uses a ferroelectric material that only operates very near or below the Curie temperature.

Claims 5-8 were rejected under 35 U.S.C. 103(a) as being upatenable over Jackson in view of McGAnn. As claim 1 was differentiated from Jackson (as Jackson does not teach tunable dielectric material, and further because claim one was modified to require the composite materials to operate in their paraelectric state) this rejection is traversed.

Claim 9 was rejected under 35 U.S.C. 103(a) as being upatenable over Jackson in view of Mueller. The Applicant reiterates the discussion above regarding the requirements for obviousness and the modification of claim 1 to include the composite material operating in its paraelectric state. Further, the aforementioned discussion regarding Jackson and the lack of any teaching of tunable dielectric material traverses this objection.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reasons, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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IN THE CLAIMS:

Please amend claim 1, 3 and 4, cancel claim 10 and add claims 11 and 12 as follows:

1. (Amended) A voltage-controlled tunable filter including:

first and second cavity resonators;

means for exchanging a signal between the first and second cavity resonators;

a first voltage tunable dielectric capacitor positioned within the first cavity resonator, said dielectric capacitor including composite materials in their para-electric state;

means for applying a control voltage to the first voltage tunable dielectric capacitors;

a second voltage tunable dielectric capacitor positioned within the second cavity resonator, said dielectric capacitor including composite materials in their paraelectric state;

means for applying a control voltage to the second voltage tunable dielectric capacitors;

an input coupled to the first cavity resonator; and

an output coupled to the [first]second cavity resonator.

2. The voltage-controlled tunable filter of claim 1, wherein each of the first and second voltage tunable dielectric capacitors includes:

a first electrode;

a tunable dielectric film positioned on the first electrode; and

a second electrode positioned on a surface of the tunable dielectric film opposite the first electrode.

3. (Amended) The voltage-controlled tunable filter of claim 2, wherein [the tunable dielectric film comprises] said composite materials are barium strontium titanate or a composite of barium strontium titanate acting in their paraelectric state.

4. (Amended) The voltage-controlled tunable filter of claim 1, further comprising:

a plurality of additional coaxial resonators, electrically coupled in series to said first and second cavity resonators;

means for exchanging a signal between the additional resonators; and

a plurality of additional voltage tunable dielectric capacitors, each of the additional voltage tunable dielectric capacitors being positioned within one of the additional resonators, said additional dielectric capacitor including composite materials in their paraelectric state.

5. The voltage-controlled tunable filter of claim 1, further comprising:

a first rod positioned in the first resonator, wherein the first voltage tunable dielectric capacitor is positioned at one end of the first rod; and

a second rod positioned in the second resonator, wherein the second voltage tunable dielectric capacitor is positioned at one end of the second rod.

6. The voltage-controlled tunable filter of claim 5, wherein:

each of the rods in the cavity resonators is serially connected with one of the voltage tunable dielectric capacitors.

7. The voltage-controlled tunable filter of claim 5, wherein:

each of the rods in the cavity resonators is grounded.

8. The voltage-controlled tunable filter of claim 1, wherein:

the input comprises a first coupling probe; and

the output comprises a second coupling probe.

9. The voltage-controlled tunable filter of claim 1, wherein each of the first and second voltage tunable dielectric capacitors includes:

a substrate;

a tunable dielectric film positioned on the substrate; and

first and second electrodes positioned on a surface of the tunable dielectric film opposite the substrate, the first and second electrodes being separated to form a gap.

10. Cancel

11. (New) A voltage-controlled tunable filter including:

first and second cavity resonators;

means for exchanging a signal between the first and second cavity resonators;

a first voltage tunable dielectric capacitor positioned within the first cavity resonator, said dielectric capacitor including $Ba_xCa_{1-x}TiO_3$, where x is in a range from about 0.2 to about 0.8 and acting in its paraelectric state;

means for applying a control voltage to the first voltage tunable dielectric capacitors;

a second voltage tunable dielectric capacitor positioned within the second cavity resonator, said dielectric capacitor including composite materials in their paraelectric state;

means for applying a control voltage to the second voltage tunable dielectric capacitors;

an input coupled to the first cavity resonator; and

an output coupled to the second cavity resonator.

12. (New) A voltage-controlled tunable filter including:

first and second cavity resonators;

means for exchanging a signal between the first and second cavity resonators;

a first voltage tunable dielectric capacitor positioned within the first cavity resonator, said dielectric capacitor including $Ba_xCa_{1-x}TiO_3$, where x is in a range from about 0.2 to about 0.8 and acting in its paraelectric state;

means for applying a control voltage to the first voltage tunable dielectric capacitors;

a second voltage tunable dielectric capacitor positioned within the second cavity resonator, said dielectric capacitor including composite materials in their paraelectric state;

means for applying a control voltage to the second voltage tunable dielectric capacitors;

an input coupled to the first cavity resonator; and

an output coupled to the second cavity resonator.